

Role of innovation in economic growth in a New Zealand context

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I'm going to be talking, essentially, about two things: first that innovation is profoundly important for New Zealand's economic performance and growth and, secondly, that to gain greater economic dividends from science, research and innovation, we need to get much more fusion and synergy between our scientists and firms.

I want to set the scene by first talking about New Zealand's relative economic performance since the 1970s (Figure 1).

In 2009, New Zealand's gross domestic product per person stood around 15% below the average for the relatively rich, developed societies in the Organisation for Economic Co-operation and Development (OECD), which put us in 22nd place in the then-30-member OECD: that's a significant relative decline from being around 15% above the average of the smaller, and

richer, OECD during the early 1970s, when we ranked eighth out of 24 member countries. New Zealand's per capita income gap with Australia emerged during the mid 1970s and has generally widened since – our GDP per capita is now about 26% less than Australia's (Statistics New Zealand 2010a).

To close the income gap with the richer OECD countries, our economy would have to grow faster than theirs for a long period. As far as closing the gap with Australia, New Zealand's average annual growth in GDP per capita would need to outpace Australia's by about two per cent a year over 15 years. That's quite a challenge.

What will drive this economic growth?

In simple terms there are two things that drive economic growth.

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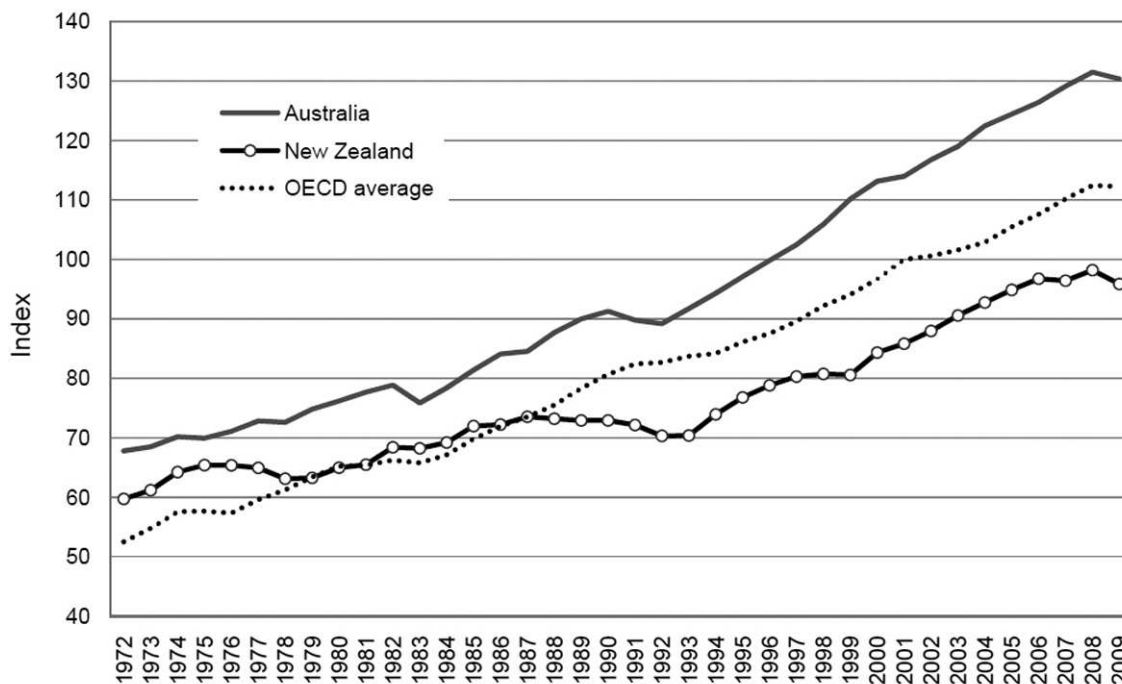


Figure 1. Real GDP per capita for Australia, New Zealand and OECD. At 2000 PPP (purchasing power parity) prices, 1972–2009. Base: OECD 2001 (=100). Source: Statistics New Zealand 2010a, Australian Bureau of Statistics 2010, and OECD Factbook 2010.



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Struan has worked in a range of economic policy roles in the public and private sector. Since joining the Treasury in 1987 he has held various senior positions within Treasury including Manager, Macroeconomic Policy, head of the Treasury's Strategy Unit, Assistant Secretary responsible for international, infrastructure and environmental issues and Acting Deputy Secretary, Economic Performance. Between 1993 and 1995, Struan was seconded from the Treasury to the World Bank, where he held an Advisor position at New Zealand's shared constituency office.

There's working harder: New Zealand is already quite good at that. We work more hours per person than the OECD average and countries like Australia and the US.

There's also working smarter: getting more output from each hour worked. Over the past 200 years, income per head in the developed world grew about 19 times. The economic evidence suggests that most, if not all, of this income growth came from improvements in productivity rather than increases in hours worked per person.

New Zealand has been poor at this. An hour worked in New Zealand produces about 30% less value-added than an hour worked in Australia – despite the fact that the rate of productivity growth across the other side of the Tasman has been slowing in recent years (OECD 2010a).

So, broadly, to lift economic growth New Zealand needs to work smarter: to get more output from each hour worked. On its own, just working harder isn't going to be enough.

How can we work smarter? We know from analysis done by the OECD that between 25% and 45% of productivity gains come from innovation. Most of the huge rise in living standards in the developed world over the last two centuries has come about through technological breakthroughs based on increased knowledge. So it's crucial that we deepen our understanding of how innovation happens and then get much, much better at it so that the economy can deliver the higher living standards we're aiming for.

What drives innovation?

Science is one critical input, but the story of how innovations arise is much more complex than putting resources into basic research to get new technologies downstream. Innovation and working smarter is all about getting new ideas flowing into the creation of new products, new and improved processes and technologies, and softer changes like new business models or novel methods of marketing and distribution.

Most innovation takes place in firms, and often this is through new ideas being generated on the shop floor, among users of systems, and in response to end-users. Firms need to innovate to compete and grow, and in the process come up with new products and processes and improvements in productive efficiency.

How good are we at innovation?

Statistics New Zealand surveys suggest that New Zealand firms have levels of product, operational and marketing innovation that compare reasonably well with other small OECD

countries (Statistics New Zealand 2008). Another indicator, the IBM–University of Auckland's Innovation Index, found that New Zealand's rate of innovative activity rose by 13% between 1998 and 2000 but then remained virtually flat for the next seven years before falling sharply in 2008. In contrast, the same index for Australia rose more than 25% in the same period (IBM New Zealand and University of Auckland Business School 2010). These figures indicate that there's plenty of potential for lifting our innovation performance.

One input to firms' innovation is research and development (R&D), but they are not the same thing (Figure 2). While business R&D is a vital part, firms that innovate do not necessarily conduct R&D – only 8% of all businesses in New Zealand perform R&D compared with much higher rates, 46%, performing wider innovation, and this disparity exists in all sizes of firms (Statistics New Zealand 2010b).

While firms are at the centre of the innovation process, government has a big role to play. The most important and most effective role for government is improving the policy settings that have a pervasive impact on firms' ability to perform: by maintaining a stable macro environment, cutting back on poor regulation, by boosting competition, addressing the taxes that are the most negative for growth, investing in infrastructure, and making the public sector more efficient. That provides us with the base, for ensuring the systems and incentives are in place that allow innovation to occur.

Secondly, R&D is an important part of the innovation system – so government has to make the most of its public investment in science to yield benefits to New Zealand. This is especially so now, when fiscal conditions are extremely tight. To get economic impact we particularly need the output from the science system to be applied in the economy by firms – the wider the better. In saying this, I recognise that science also contributes to other important outcomes for New Zealand, including environmental, health and social. That said, being from Treasury, I tend to use an economic lens.

Getting economic impact from our public investment in science

There's no doubt that New Zealand produces very good science, and leads the world in some areas. We have a strong research base – for example, we are placed ninth out of 23 OECD countries in terms of the number of science and engineering articles published per one million inhabitants (OECD 2006). We also rank sixth out of 28 OECD countries for the number of R&D personnel per 1000 people employed (OECD 2010b).

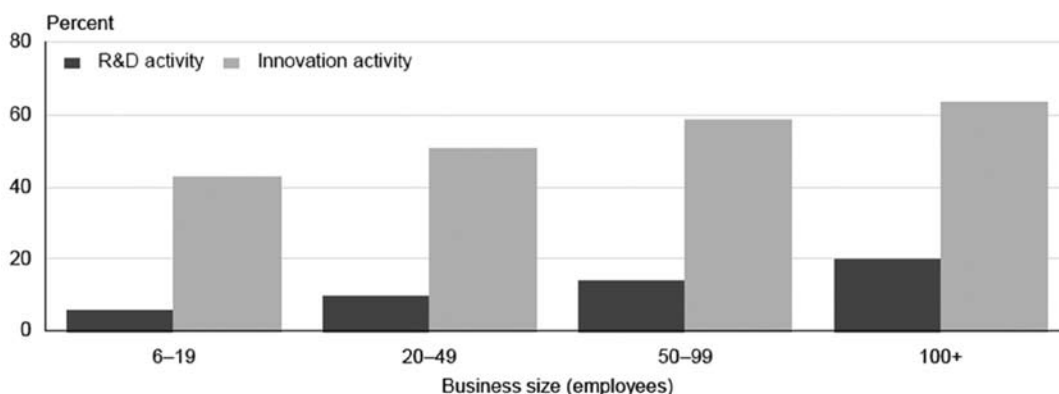


Figure 2. Research & development (last financial year) and innovation activity (last two financial years), by business size, to August 2009. Source: Statistics New Zealand 2010b.

However, when it comes to converting this knowledge into commercial opportunities and higher value, we do not do as well; this was confirmed by the OECD which has highlighted that technology diffusion and adoption is a weakness for New Zealand (OECD 2007).

Getting science connected with business is the key, so science can give business a hand-up to solve problems entrepreneurs are grappling with and to realise opportunities they have glimpsed. As important – or even more important – out of this synergy can come unanticipated developments for novel products or processes, opening up completely new products, applications and markets.

A case in point is the development of the electric fence.

It was Bill Gallagher who first developed the first electric fence and supplied it to New Zealand farmers. These fences were battery-powered and did a reasonable job, but their usefulness was limited because, if grass touched the wire, the voltage would drop and the animals could just walk through. What led to the electric fence industry taking off was the invention of unshortable electric fence technology by a public sector scientist working at Ruakura. The new reliable fences, powered from the mains supply, utilised a high current in short bursts which were safe for both livestock and people. Since then, Gallagher's commercialisation of the improved technology has revolutionised farm grazing around the globe, and unforeseen diverse applications have arisen – from corralling big-game animals to electrical and alarmed security fences to keep people in or intruders out.

Of course, impacts can also be unforeseen. A rich source of unforeseen applications arises when researchers and users get together and share their ideas and perspectives.

An example is the 'camera pill' – a disposable pill-sized camera that passes straight through the digestive tract, continuously broadcasting pictures of the intestine to an external receiver. This was invented by a guided-missile designer in Israel who got the idea after talking with a gastroenterologist who was suffering from undiagnosed stomach pain. This story also illustrates the benefits of being connected internationally. The concept of a camera pill was actually being developed independently in Israel and Britain. These two groups of scientists

later got together and successfully collaborated to develop the technology.

So getting users and scientists to talk to each other, to understand each other's perspectives and feed off each other's ideas will be an important part of getting our innovation system humming. While this is already happening to some extent, we think there is room for improvement.

Survey results show that 'existing staff' and 'customers' were the most common sources of information that businesses used for the purposes of innovation (Figure 3). Less than 10% of businesses rated either 'universities or polytechnics' or 'Crown research institutes (CRIs), other research institutes, or research associations' as important sources of information.

The picture is much more varied at the industry level.

In the education and training industry, 22% of businesses rated 'universities or polytechnics' as important sources of information of innovation, but only 1% in the retail trade industry did so.

In the primary sector, 23% of businesses in the agriculture, forestry, and fishing industry rated 'CRIs, other research institutes, or research associations' as important sources (Statistics New Zealand, 2010).

However, what strikes me most is the potential for a much greater flow of information between our public research organisations and firms – and I can't help thinking what great ideas we could be missing out on. I hope that's a thought you'll take away too.

Recent changes in the science sector

There have been wide-ranging changes in the science sector in the past year aimed at supporting economic growth. These include:

- Early next year will see the amalgamation of the Ministry of Research, Science & Technology and the Foundation for Research, Science and Technology into the new Ministry of Science and Innovation (MSI). This will bring policy making and funding together, remove some fragmentation in the system, and give the sector a single and stronger lead agency.

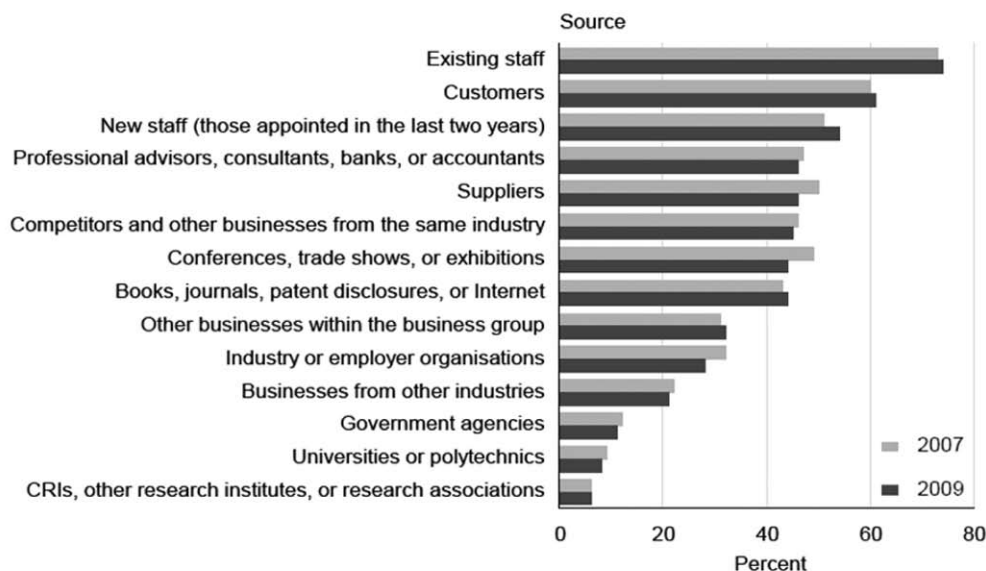


Figure 3. Sources of information for innovating businesses (last two financial years at August 2007 and 2009). Source: Statistics New Zealand 2010b.

- The Taskforce set up a year ago to examine how the CRIs can best deliver on national priorities and contribute to economic growth, has reported. The process of implementing its recommendations is under way.
- Business R&D has been growing in recent years from a low base. Although our business R&D is relatively low by international standards this can be largely explained by our industry structures, size of firms, and distance to market. Given that a large body of empirical evidence suggests that business R&D has a significant impact on economic growth, encouraging it is important. Budget 2010 made provision for four initiatives to boost business R&D and improve technology transfer and commercialisation from publicly funded research to firms (technology development grants, technology transfer vouchers, the national network of commercialisation centres initiative, and technology transfer initiatives).
- In the tertiary education sector there have been changes to the Performance-Based Research Fund evaluation process to ensure that excellence in applied and commercial research is properly rewarded.

Where do we go from here?

We need to ensure we get the best out of these substantial changes in the science system. The new MSI will need to live up to its name and ensure that innovation is as central as science policy. It will probably mean some shift of focus and funding from 'blue skies' and basic research to applied research of relevance to firms. It will need to apply energy and drive to getting a step-change in collaboration and knowledge transfer both within the science sector and between the science sector and firms.

New Zealand only produces a very small percentage of global knowledge, so we have to be smart technology adopters. To do this we need to be deeply connected with the global innovation system. We already have many good linkages with international science, but I think we can do even more. We need our public research organisations not only to be excellent at keeping abreast of leading-edge science and emerging technology, but also to excel at adapting it for New Zealand settings and turning it into commercial opportunities for our firms.

We need to ensure that the CRI reforms help to maximise the economic benefit from CRI research, and to get this we need New Zealand firms to be able to turn these findings into profits. We need them to forge partnerships with the private sector to help CRIs plan their research more in line with the needs of industry, and give the private sector an early insight into potential investment opportunities. It's vital too that CRIs put a much greater emphasis on transferring the knowledge and technologies they generate to New Zealand businesses.

The new arrangements for funding and monitoring CRIs will help cement this in.

The new business R&D incentives and commercialisation initiatives are under way. We need to ensure that they are evaluated properly and learn from our experience of them in practice. We want to facilitate Commercialisation Centres to build up scale, expertise, and networks so that they become excellent at commercialising bright ideas. It's Treasury's view that further incentives for business R&D are worth considering, but these will need to be within the bounds of our fiscal constraints.

We must also build up a stronger focus, not just on commercialisation and technology push, but knowledge transfer more generally. To capitalise on our innovation potential, we have to ensure that the flow of ideas is genuinely two-way, not just from public research organisations to firms but from firms to scientists, scientists to scientists and, where possible, from firms to firms. Building stronger networks, with highly mobile researchers with strong links to industry, will be part of this, as well as accessing and adapting the best ideas from abroad.

Conclusion

I want to leave you with the message that New Zealand's future economic performance will depend on innovation. Research is one important input to this, but ultimately it is firms that take up and apply it for economic benefit for New Zealand. To get the best out of our science system, the flow of ideas between the science system and firms needs to be strong and genuinely two-way.

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